Malaria *(Plasmodium spp.)*

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1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

There are four *Plasmodium* species (sporozoan parasites) that cause malaria in humans. They are *Plasmodium vivax, P. malariae, P. ovale* and *P. falciparum*.

B. Clinical Description and Laboratory Diagnosis

The classic symptoms of malaria are high fever with chills, sweats, and headache, which may be paroxysmal (involving recurrence or intensification of symptoms). The fever and paroxysms generally occur in a cyclic pattern. Depending on the infecting species, fever may appear every other or every third day. Other symptoms can include malaise, nausea, vomiting, diarrhea, cough, arthralgia (joint aches), respiratory distress and abdominal and back pain. Pallor and jaundice may also be present. Enlargement of the liver and spleen (hepatosplenomegaly) may occur and is more prominent in chronic infections. Infection with *P. falciparum* is potentially fatal and most commonly manifests as a febrile illness without specific or localizing signs. Falciparum malaria may present with coagulation defects, shock, renal and liver failure, acute encephalopathy, pulmonary and cerebral edema, and coma. The case-fatality rate is 10–40% in the absence of prompt treatment. The duration of an untreated primary attack can vary from a week to a month or longer. Relapses of *P. vivax* and *P. ovale* infections can occur at irregular intervals for up to 5 years. *P. malariae* infections may persist for life (chronic infections), with or without recurrent episodes of fever.

Laboratory diagnosis is based upon microscopic demonstration of malaria parasites in blood smears. Diagnosis by PCR is the most sensitive method available but it is not generally available in diagnostic laboratories.

C. Reservoirs

Humans are the only important reservoir of human malaria. Non-human primates are naturally infected by many malarial species that can potentially infect humans, but natural transmission from non-human primates to humans is extremely rare.

D. Modes of Transmission

Malaria is transmitted by the bite of an infective female *Anopheles* mosquito. Transmission can also rarely be congenital (via the placenta) and can occur through blood transfusions or the use of contaminated needles.

E. Incubation Period

The time between the infective bite and the appearance of clinical symptoms is approximately 7–14 days for *P. falciparum*, 8–14 days for *P. vivax* and *P. ovale*, and 7–30 days for *P. malariae*. With some strains of *P. vivax*, mostly from temperate areas, there may be a prolonged incubation period of 8–10 months; even longer incubations may occur with *P. ovale*. With infections acquired by blood transfusion, the incubation period depends on the number of parasites infused; it is usually short, but may range up to 2 months.

F. Period of Communicability or Infectious Period

Malaria is not directly communicable from person-to-person except for congenital transmission; however, during parasitemia, the disease may be transmitted to other persons through blood transfusion or through shared contaminated needles. Infected human hosts remain infectious for *Anopheles* mosquitoes for prolonged periods of time (1–3 years, or longer, depending on the species) if they are not adequately treated.

G. Epidemiology

Malaria is endemic throughout the tropical areas of the world. About half of the world's population lives in areas where transmission occurs. Areas with the highest prevalence include sub-Saharan Africa, parts of Central and South America, India, and parts of Oceania and Southeast Asia. Transmission is also possible in more temperate climates such as in the United States, where *Anopheles* mosquitoes are present. Mosquitoes in airplanes flying from tropical climates have been the source of occasional cases in persons working or living near international airports. However, nearly all of the malaria cases reported annually in the United States (~1000) are acquired abroad. *P. vivax* and *P. falciparum* are the most common species worldwide. The worldwide spread of strains of chloroquine-resistant *P. falciparum* and *P. vivax* is of increasing importance. Resistance to other antimalarial drugs is now occurring in many areas where the drugs are widely used. In New Jersey an average 62 cases of malaria per year are reported to the NJDHSS.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. NJDHSS Case Definition

CASE CLASSIFICATION

A. **CONFIRMED**
Microscopically confirmed malaria parasitemia in any person (symptomatic or asymptomatic) regardless of whether the person experienced previous episodes of malaria while outside of the country.

B. **PROBABLE**
Not used.

C. **POSSIBLE**
Not used.

NOTE: A subsequent attack experienced by the same person but caused by a different *Plasmodium* species is counted as an additional case. A subsequent attack experienced by the same person and caused by the same species in the United States may indicate a relapsing infection or treatment failure caused by drug resistance.

B. Laboratory Testing Services Available

Giemsa stained thin and thick blood smears can be submitted to the New Jersey Department of Health and Senior Services for confirmation and speciation of *Plasmodium.* New Jersey Department of Health and Senior Services, Division of Public Health and Environmental Laboratories, Specimen Receiving and Records, P.O. Box 361, John Fitch Plaza, Trenton, NJ 08625-0361.
For additional information, contact the Enteric Laboratory at 609.292.7368.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify imported cases of malaria.
- To ensure that cases are appropriately contained and treated to prevent the introduction of malarial parasites into native mosquito populations.
- To identify locally acquired cases, if they occur, so appropriate active surveillance and mosquito control interventions can be implemented.
- To provide travelers with appropriate preventive health information.

B. Laboratory and Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that laboratories report (by telephone, confidential fax or in writing) all cases of malaria to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located.

C. Local Departments of Health Responsibilities

1. **Reporting Requirements**

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of malaria, as defined by the reporting criteria in Section 2A above. Current requirements are that cases be reported to the NJDHSS Infectious and Zoonotic Diseases Program using official CDC Malaria Case Surveillance Report Form (see instruction how to fill it). A report can be filed electronically over the Internet using confidential and secure Communicable Disease Reporting System (CDRS).

2. **Case Investigation**

a. It is the local health officer's responsibility to complete the reporting form by interviewing the patient and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the patient's healthcare provider or the medical record.

b. Use the following guidelines for assistance in completing the form:

1) Accurately record the demographic information, date of symptom onset, pregnancy status, healthcare provider information, and whether hospitalized (including location and associated dates). **Please enter patient street address, municipality and phone number on the back of the form**.
2) Accurately record laboratory results, particularly the species of malaria, and the laboratory that performed the testing.
3) Record information about whether and where the patient has spent time out of the country in the past four years, including duration of stay and date returned.
4) Indicate whether the patient took malaria prophylaxis and, if so, what kind.
5) Record whether the patient has had a history of malaria within the past 12 months.
6) Record whether the patient has had a blood transfusion within the past 12 months. *Note:* If the patient is a recent blood donor, this information should be provided to the Surveillance Program as soon as possible so CDC and other appropriate agencies can be notified.
7) Be sure to record all clinical complications and whether the illness was fatal.
8) Indicate which therapy was given for this illness.
9) Check if the laboratory diagnosing malaria submitted the blood smear to PHEL.

There is a "Continuation" section on the back of the form which can be used to document other relevant aspects of the investigation that are not captured elsewhere on the form (*e.g.*, other risk information such as recent history of injection drug use or perinatal transmission, history of malaria prior to the last 12 months, any medical care received abroad).

10) If you have made several attempts to obtain case information (*e.g.*, the patient or healthcare provider does not return your calls or does not respond to a letter, or the patient does not divulge information or is too ill to be interviewed), please fill out the form with as much information as possible. Please note on the form the reason why it could not be filled out completely. **If CDRS is used to report, enter collected information into the "Comments" section.**

c. After completing the form, it should be mailed (in an envelope marked "Confidential") to the NJDHSS Infectious and Zoonotic Diseases Program, or the report can be filed electronically over the Internet using the confidential and secure Communicable Disease Reporting System (CDRS). The mailing address is:

NJ DHSS

Division of Epidemiology, Environmental and Occupational Health
Infectious and Zoonotic Diseases Program
PO Box 369
Trenton, NJ 08625-0369

d. Institution of disease control measures is an integral part of case investigation. It is the local health officer's responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4, "Controlling Further Spread."

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (N.J.A.C. 8:57-1.10)

Minimum Period of Isolation of Patient
No restrictions except for exclusion from blood donation.

Minimum Period of Quarantine of Contacts
No restrictions.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Locally Acquired Case
A locally acquired case of malaria is possible but would be unusual (*Anopheles* mosquitoes are present in New Jersey but infected humans are rare). If you determine during the course of an investigation that a patient does not have a recent travel history to an endemic country, measures such as investigating local areas visited by the patient to locate the focus of infection and surveillance of other people for illness may be necessary. Contact the NJDHSS Infectious and Zoonotic Diseases Program. The Program staff can help determine a course of action to prevent further cases and can perform surveillance for cases that may cross several jurisdictions and therefore be difficult to identify at a local level.

Reporting Locally Acquired Case or Suspected Outbreak
If a locally acquired case of malaria is diagnosed in a city/town, or if an outbreak is suspected, investigate to determine the source of infection and mode of transmission. Contact the NJDHSS Infectious and Zoonotic Diseases Program. The Program staff can help determine a course of action to prevent further cases and can perform surveillance for cases that may cross several jurisdictions and therefore be difficult to identify at a local level.

D. Preventive Measures

International Travel

- People traveling to malaria-endemic parts of the world should be notified of their risk of contracting the disease and control measures they can take to protect themselves from mosquitoes. Travelers can use repellents, wear protective clothing and use mosquito nets when rooms are not screened.
- Detailed recommendations for preventing malaria are available 24 hours a day from the CDC Malaria Hotline, which can be accessed by telephone at (770) 488-7788, by fax at 888.232.3299, or CDC's website at <http://www.cdc.gov/travel>.
- Travelers and recent immigrants from malaria-endemic regions with symptoms suggestive of malaria should be referred to a healthcare provider for prompt testing and treatment. Failure to treat individuals with malaria could lead to their becoming a local source of malaria transmission to mosquitoes if bitten, then to other people bitten by those mosquitoes.

ADDITIONAL INFORMATION

A *Malaria Fact Sheet* can be obtained at the NJDHSS at <http://www.state.nj.us/health>.

The formal CDC surveillance case definition for malaria is the same as the criteria outlined in Section 2 A. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. For reporting a case to the NJDHSS, always refer to the criteria in Section 2 A.

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